

# CONSTRUCTIVELY SPEAKING

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Issue No. 12

## ASPHALT ROADS IN AFGHANISTAN

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*BY: Bill Neimes, P.E., Laghman PRT*

Asphalt roads, if constructed properly, are durable roads that provide a surface that is smooth and reliable for traffic. There are several critical factors that provide for a long-lasting, durable asphalt road including: properly sized hydraulic structures, a densely compacted sub grade, sub base and base course material and a high quality asphalt finish. This article will discuss the important steps in developing a high quality asphalt product. Asphalt consists of different sized aggregate heated and mixed with bitumen. Each portion of the asphalt process is important from the materials being used to the production of asphalt to the placing and compaction process. The first two sections of this article describe the components of asphalt, bitumen and aggregate. The next sections describe the different layers that are applied to a typical Ministry of Rural Rehabilitation/Ministry of Public Works asphalt road. These include: the prime coat, binder course, tack coat, and wearing course. The last two sections provide testing information and explain the asphalt plant.

**Bitumen.** Bitumen is the material used as the binding agent in asphalt. Bitumen is typically shipped in 200 kg drums with a volume of approximately 55 gallons. Bitumen is shipped as a solid material and is heated when producing asphalt. Bitumen is available in different grades with the grade value dependent upon the penetration index. The higher the penetration index,

the higher the grade value. Most bitumen in the lower altitudes of Afghanistan is purchased as 60/70 grade. At higher elevations and colder climates, the penetration index for bitumen will be 80/100. Bitumen can be purchased from several different neighboring countries. The primary suppliers are countries located north of Afghanistan, but bitumen may also be imported from Pakistan, Iran or other oil producing countries. Different contractors prefer bitumen from certain countries, but it is difficult to evaluate the quality of bitumen based on the country it is purchased from. The price of bitumen has increased significantly during the past year as the price last year was approximately \$450/metric ton but the current price is around \$750 per metric ton. Photo 1 shows a yard filled with bitumen drums that will be used for asphalt.



**Photo 1**

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The workers at the asphalt plant are removing the bitumen from the drum in Photo 2. After the bitumen is removed from the drum it is placed in a heated tank to liquefy the bitumen (Photo 3). The emptied, cutout drums are stockpiled until they are shipped of and recycled (Photo 4). The contractor receives approximately \$3 per empty drum.



Photo 2



Photo 3



Photo 4

**Aggregate.** Aggregate is the main component of asphalt. Asphalt typically contains approximately 95 percent of different sized aggregate. Because of this, there are several tests conducted to determine if the aggregate is of good enough quality. These tests include evaluating the number of fractures faces (COE CDR-C 171), the percentage of loss from abrasion (ASTM C 131), and if the aggregate is cubical rather than flat (ASTM D 4791). If the aggregate source is acceptable, the aggregate is sorted by sieve size.

Different ratios are evaluated to determine the best product and once these ratios are tested in the mix design, the contractor must follow this mix design. Contractors in Afghanistan either purchase the aggregate from a supplier or use a crushing plant to crush their aggregate. Photo 5 shows aggregate from a crushing plant with the crushing plant in the background. Either method for obtaining crushed aggregate is acceptable as long as the aggregate meets the specifications. The fine aggregate should be kept covered during non-use hours

(Photo 6) to keep the material dry as aggregate must be dried prior to use.



Photo 5



Photo 6

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The contractor should make sure there is no overspill when filling the storage bins as this will give different ratios than specified (Photo 9). Each bin is set for the proper ratio and distributed accordingly (Photo 10). A large screen is used



Photo 7

to filter an oversized aggregate as shown on Photo 11. Once the aggregate is proportioned and screened, it is sent through a kiln to be heated prior to mixing with bitumen (Photo 12). If the aggregate is not dry, the kiln will not properly heat the aggregate and a good mix between the aggregate and bitumen will not occur. If the pile of aggregate is not dried, the contractor typically spreads the

aggregates are placed. The contractor should make sure there is no overspill when filling the storage bins as this will give different ratios than specified (Photo 9). Each bin is set for the proper ratio and distributed accordingly (Photo 10). A large screen is used to filter an oversized aggregate as shown on Photo 11. Once the aggregate is proportioned and screened, it is sent through a kiln to be heated prior to mixing with bitumen (Photo

12). If the aggregate is not dry, the kiln will not properly heat the aggregate and a good mix between the aggregate and bitumen will not occur.



Photo 10



Photo 8



Photo 11

aggregate out for several hours during a sunny day (Photo 7). During the mix design, the ratio of aggregates is selected and is segregated into four different sizes: large aggregate, medium sized aggregate, small aggregate and fines. The cold bin storage for aggregates include four different sized bins (Photo 8) in which the different sized aggregates are placed.



Photo 9



Photo 12

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**Prime Coat.** The prime coat is the first layer for an asphalt road. This prime coat is applied to aggregate base course and the primary purpose of a prime coat is to increase the bonding between the aggregate base course and the asphalt layer applied above the base course. The prime coat also bonds loose particles on the surface of the base course.

Before the prime coat is applied, the aggregate base course must be clean and dry. Typically this includes workers



Photo 13

sweeping off the heavier material with a brush (Photo 13) and blowing off the finer material with an air compressor (Photo 14).



Photo 14

The prime coat consists of a mixture of bitumen and cutting solution, such as kerosene, and is applied to the aggregate base course with a tanker truck and distributor that applies an even coat. Photo 15 shows any even prime coat applied over the road. Many times some of the nozzles of the spray bar on the distributor are clogged and there will be sections of the road that are not coated (Photo 16). The contractor will either have to reapply another coat over the missed areas either by tanker truck or by hand application.



Photo 15



Photo 16

The rate of application varies but is typically around 1 liter/square meter of road surface. This is measured by placing a specific sized pan on the road and determining the application rate by weighing the pan before and after application (Photo 17). A common problem when applying the prime coat is overspray. After one side of the road is asphalted, the contractor must be sure that they do not apply prime coat on the asphalted road as this will damage (weaken) the asphalt (Photo 18). After the prime coat is applied the prime coat must dry prior to applying the asphalt layer. There should be a minimum of 24 hours after the prime coat is applied before applying asphalt as this allows the volatiles to escape and the prime coat to harden. To avoid vehicle traffic during this drying period, the contractor will place stones along to act as a blockade as shown on Photo 19. Even with stones in the road, the contractor has difficulty controlling traffic and damage to the prime coat can result as shown on Photo 20.

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Photo 17



Photo 18



Photo 19



Photo 20

**Binder Course.** The binder course is the first layer of asphalt applied to the road. The MRRD/MPoW standard drawings require a 60 mm or 6 cm thickness for binder course asphalt and most specifications require this standard thickness for asphalt roads. Before any asphalt is applied to the road, the contractor will test different ratios of bitumen and aggregate to determine the correct job mix formula. The Marshall test is used to evaluate certain parameters based on different asphalt contents. Figure 1 shows Marshall Test results for an asphalt road in Mehtar Lam, Afghanistan. For this test, the optimum bitumen content was 4.7%.

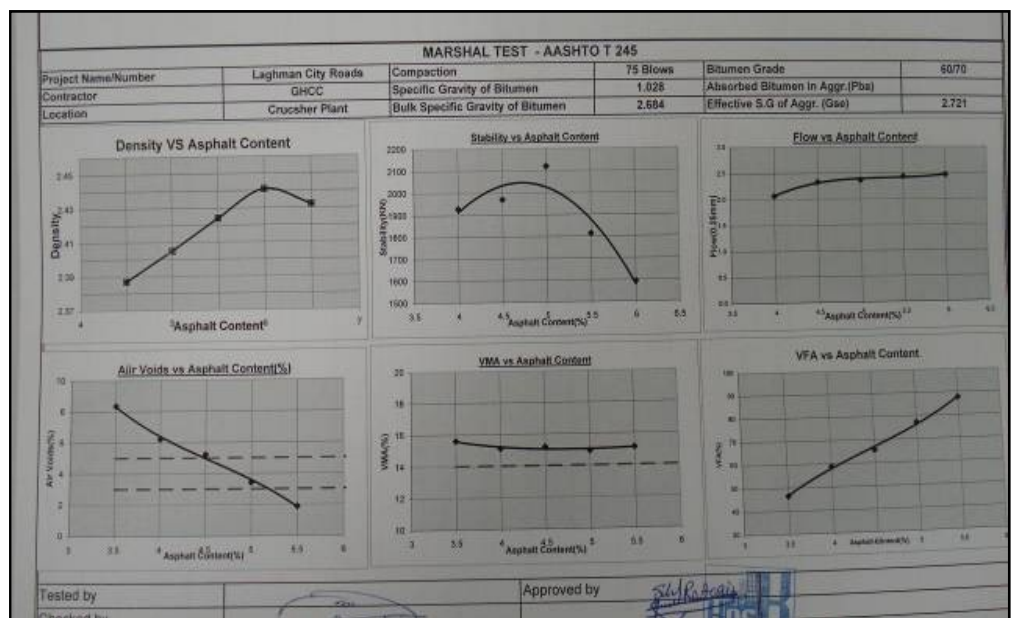


Figure 1. Marshall Test Results

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Once a job mix formula is approved for use, the asphalt plant will attempt to achieve the same ratios as during the test. It is critical that all aspects of the asphalt plant are operating properly and an experienced asphalt plant operator is invaluable to obtaining a correct asphalt mix. Once asphalt is processed in the plant it is discharged through a conveyor belt in a loader



Photo 21



Photo 22

truck for transporting to the job site (Photo 21). It is important that not too much asphalt is placed in a loader truck as segregation of the asphalt mix may occur. During cold weather, transport trucks should be covered so that the temperature loss during transport is kept to a minimum. Once the truck arrives at the job

site, the asphalt is loaded in a paver machine where asphalt is applied at a specific rate (Photo 22). The contractor should place a test section to determine the thickness of asphalt prior to compaction. There should be several

workers behind the paving machine to assure the asphalt is not segregated (Photo 23). The most important criterion for compaction is the temperature of the asphalt. The temperature of the asphalt should be monitored at the plant and at the job site. Specifications require



Photo 24

a certain minimum

temperature and this should be measured during compaction of the asphalt. Photo 24 shows the asphalt temperature being measured after initial compaction. After the asphalt paver applies the asphalt, there are two compaction equipment, the steel wheel roller and pneumatic tire roller, which apply pressure to the asphalt to provide the appropriate compaction (Photo 25). Core samples are collected at specific intervals along the right, left and center of the road to evaluate the thickness of the binder course after compaction. Photo 26 is a core sample of binder course showing a thickness of 6.8 cm.



Photo 23



Photo 25



Photo 26

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**Tack Coat.** A tack coat is a very light application of bitumen between the binder course layer and the wearing course asphalt layer. A tack coat is used to ensure a good bond between the existing pavement surface and the new hot mix asphalt overlay. The preparations before applying the tack coat are similar to that of the prime coat. The surface must be clean and dry. The application rate of the tack coat is typically less than one-half that of the prime coat and is not used to penetrate the binder course but is only use to bond the two asphalt layers together. Photo 27 shows the tack coat layer over the binder course asphalt layer and Photo 28 show a clean and dry asphalt layer on one side of the road and the tack coat layer on the other side with the wearing course asphalt layer being applied over the tack coat.



Photo 27



Photo 28

**Wearing Course.** The final application for an asphalt road is the wearing course layer. The wearing course provides not only the initial load distribution but also a weather proof finish and a smooth surface. The MRRD/MPoW standard drawings requires a 40 mm or 4 cm thickness for wearing course asphalt and most specifications require this standard thickness for asphalt roads. As in binder course application, before wearing course asphalt is applied to the road, the contractor will test different ratios of bitumen and aggregate to determine the correct job mix formula. The Marshall test is used to evaluate certain parameters based on different asphalt contents. The main difference between the binder course and wearing course asphalt is the sieve ratio. Wearing course asphalt will contain a higher percentage of finer material to provide a smoother surface whereas binder course asphalt will contain a higher percentage of larger sized aggregates to provide more load bearing capacity. Photo 29 shows an asphalt core from a road. The length of this core is over 4 inches (10 cm) and this meets the MRRD/MPoW standard drawings. The wearing course material is located in the top 1.5 inches of this core whereas the binder course material is located in the lower 2.5 inches. This photo shows the aggregate size in the wearing course is smaller than the binder course.



Photo 29



Photo 30

## ASPHALT ROADS IN AFGHANISTAN

**Testing.** There are several tests that are performed during application of an asphalt road. Either the contract documents or specifications will include the type of test and frequency of test. The laboratory performing the analysis should be certified by the Corps of Engineers Quality Assurance Section. Some of the common tests have already been described in previous sections. During application of the binder course and wearing course asphalt, grab samples are collected to evaluate the Marshall Test parameters at the lab. Grab samples are collected after the asphalt paving machine places the asphalt and before compaction. Photos 31 and 32 show grab sample being collected from the road to be taken to the laboratory for performing a Marshall Test. After the asphalt is compacted, cores are collected by a coring machine as shown on Photo 33. Photo 34 shows a sampled being weighed in the field after either a prime coat or tack coat application.



Photo 31



Photo 32



Photo 33



Photo 34

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**Asphalt Plant:** Asphalt is generated at the asphalt plant and a plant would include a bitumen tank, aggregate storage bins, a kiln, and a pug mill where the bitumen and aggregates are mixed. The operations are controlled in an operations center, shown in Photo 35. This would include controls and gages to monitor the temperatures and mix ratios. It is important to have an experienced operator controlling the asphalt plant to assure proper operating conditions are achieved. Photos 36 and 37 show operators at two different asphalt plants controlling feed rates and operating conditions. Some of the operating gauges in the plant are shown on Photo 38. Environmental standards are not strictly enforced as there are no controls on air emissions from the plant. Depending upon the efficiency of the plant, emissions from the plant could vary from that shown in Photo 39 to that shown in Photo 40.



Photo 35



Photo 36



Photo 37



Photo 38



Photo 39



Photo 40

## RIBBON CUTTING CELEBRATION

*BY: Dan Nordstrom, Project Engineer, Mazar-e-Sharif Resident Office*

**When Dan sent me the pictures from a recent ribbon cutting ceremony, I immediately saw a success story. Dan was kind enough to write a short article about this event and thought it would be nice to share. This is not just about a ribbon cutting which is success by itself, but rather the relationships that were developed along the way. Through partnering and teamwork anything is possible. This is Dan's story:**

'07' Contract Completion, ( or very nearly so...) and a great reason to celebrate! Mazar-e-Sharif Resident Engineer Charles Comeau, Project Engineer Dan Nordstrom and Deputy Resident Engineer Haroon Paikan recently shared ribbon cutting honors in Faryab province for Ten (10) ANP Uniformed Police District Headquarters facilities. The culmination of over Three (3)



years of hard work, weeks of final inspections, testing and training, the surprise ribbon cutting ceremony and lunch afterwards were arranged and hosted by Engineer Rahmatullah Faiq, QC Manager for contractor DORA "Development Organization for the Revival of Afghanistan". The team shared (literally) platters of traditional Afghan foods such as Qabli Palaw (rice, raisins & lamb) fresh baked Nun (round breads) and some especially sweet water-melon.

The construction team for the 5.98 Million Dollar contract came together and worked especially hard over the last Six (6) months to overcome numerous obstacles, including nearly impossible site access, floods, washed out roads, dry wells, under-current power supplies and of course the ubiquitous insurgent and their activities, in order to complete and turn over Ten (10) of Eleven (11) sites. The last site, nearly complete, is located in the mountainous area of Kohistan. Access is very difficult and limited due not only to the terrain but to the presence of anti-coalition forces in the area.

Engineer Fahim Yadqari, USACE Local National QAR, played an important role in the successful completion of these sites. Engineer Yadqari developed and cultivated an important working relationship with the Contractors staff and field personnel. Engineer Yadqari was the key to insuring contract compliance and a high quality finished product. The opportunity to associate and work with fine young people such as Engineer's Yadqari Paikan and Rhamatullah will without a doubt remain the most fulfilling and rewarding experience of my career.

On this particular day we did more than just recognize the successful completion of these sites. In addition to sharing a wonderful meal and strengthening the bonds of friendships that will last a lifetime, we made memories that will last forever. Someone asked what I thought about our little celebration. Without much forethought, I told him that it was a "Hearts and Minds" thing. It was at that very moment when I realized just how successful "they" had been at winning my heart and mind. Some days you stop to look around and you find yourself wondering "is this for real"? Rhamatullahs urging me to eat that last bite of lamb assured me that it is.



# ADVANTAGES OF DIRECT INTERFACE WITH CONTRACTORS ON SCHEDULE MANAGEMENT

BY: Phillip DiSalvi, Senior Scheduler, Baker Group

Q: How many iterations of a baseline schedule does it take to get a schedule approved?

Q: How many times will a contractor be required to submit and resubmit his baseline for review before it finally becomes acceptable as a basis for payment and a tool by which the contractor can effectively manage the project?

A: As many times as it takes to get it right.

Unfortunately, due to the poor quality of schedule submittals, contractors are forced to submit and resubmit both baseline schedules and schedule updates multiple times before they can be considered for acceptance. Too frequently, the process extends far beyond the beginning stages of field work. And because the contractor's payment application is tied to the schedule, by which progress for payment is measured, any unnecessary delay in schedule acceptance may very well impact the contractor's ability to perform.



How can we be more effective in helping the contractor in preparations of a better quality schedule? Understanding the root cause is the first step. This condition is a result of a lack of necessary information coupled with a lack of knowledge; or how to apply such information. A fusion of Information and knowledge is the key to success in many facets of life, and it's relevancy to construction scheduling must be emphasized. Clearly, schedule specific information and knowledge is crucial to the successful execution of any construction project.

Providing fundamental information to the contractor prior to preparation of the baseline schedule is key to compliant schedule development. Providing the knowledge on how to apply the information is just as important in assisting the contractor in successfully preparing its baseline schedule. This two-prong approach should be accomplished early in the life

of a contract by providing the contractor with a set of schedule development guidelines, an electronic "shell" schedule file containing all required activity coding, and finally, instructing the contractor on the application of each at the preconstruction meeting.

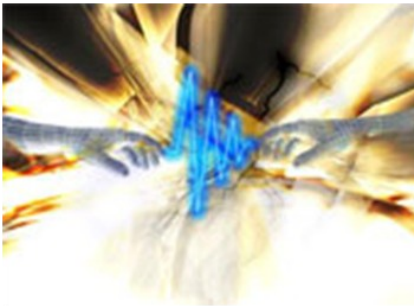
The addition of schedule specific discussion at the preconstruction meeting, with a schedule instruction meeting following the precon, will provide an opportunity for a senior scheduler from the Baker Group to better convey the necessary schedule specific information to each contractor, and to provide an opportunity for coaching the contractor's scheduler on how to apply the schedule development guidelines.

Critical to this effort is providing the necessary schedule development information and knowledge **before** the contractor starts its baseline schedule development. A precon "schedule" meeting with the contractor is an essential component of the overall effort to educate each contractor about the requirements for developing and submitting baseline schedules and subsequent schedule updates. This effort will help contractors avoid the need to repeatedly correct noncompliant schedule issues that we tend to see over and over.



The Baker Group also provides basic and advanced schedule training to contractors, which has resulted in the submission of more compliant schedules. These classes have enhanced contractors' scheduling expertise resulting in fewer baseline and update rejections. However, many of the contractors have not had the opportunity to participate in the training classes. Therefore, in addition to a recommended precon "schedule" meeting, CORs are further urged to encourage their contractor to attend the advanced schedule training courses conducted by the Baker Group.

# ADVANTAGES OF DIRECT INTERFACE WITH CONTRACTORS ON SCHEDULE MANAGEMENT



In addition to preconstruction schedule coordination and the advanced schedule training, we have found that attending weekly progress meetings, either in person or by phone, is vital to effective schedule management. Participating in these weekly meetings provides the opportunity for a Baker senior scheduler to interface directly with both the USACE team and contractors. This interaction allows for a better understanding of project specific schedule issues, and also provides an opportunity to guide the contractor to appropriate options for resolution of those issues.

The time to get involved with the contractor in schedule development is before he builds his schedule, and prior to commencement of any construction work. The preconstruction meeting is the perfect opportunity to provide the contractor with schedule development guidelines and the knowledge of how to use them in developing his baseline schedule. In addition, working with the contractor by way of a weekly schedule meeting will further assist in ensuring the submission of timely compliant schedule updates.

The end result of the additional interface with the contractor on schedules will be more timely and compliant schedule submissions, resulting in better quality schedules which can be used more effectively as a management tool by both the contractor and USACE.

If you have any questions regarding this topic, please contact the Baker Group via email [TAN.BAKER.GROUP@USACE.ARMY.MIL](mailto:TAN.BAKER.GROUP@USACE.ARMY.MIL), or stop by the Azadi Office. With a team of in-country professionals experienced in a broad range of construction specialties, Baker provides construction management support services to the Corps of Engineers, including analysis of contractor schedules (baseline and update), BCOE recommendations and claims evaluations. The Baker group also provides scheduling assistance to contractors, in addition to offering formal schedule training classes. Other services include: RMS support; database development and support; PASS and P2 support; and custom reports from Primavera, RMS, and PASS.



## ELECTRICAL SAFETY HECP

*BY: Jason Hasenoehrl, Quality Assurance Branch*

Once again it is time for electrical safety to be addressed. This time we shall talk about the HECP (Hazardous Energy Control Program).

Even though people say "It will only take a minute" and "We don't need to bother and turn off a breaker and lock it out". It only takes that one time for the electrical current to find its way to the path of least resistance, that maybe you or coworker working on the same circuit at another location. If the proper HECP is followed then any person working on the job site will be aware of the dangers and what they can safely work on.

The EM385-1-1 section 12 has the proper procedures for setting up and maintaining the HECP. The section includes the use of an AHA to provide the workers an awareness of the dangers involved on the job, training on the proper use of the HECP and the equipment used to protect the work-

the equipment to be locked out, and the procedures used to install and remove the locks and tags on the equipment that that is to be serviced or repaired. To finish up there is a reason for the EM 385-1-1 to have this information contained within. That is because no matter how safe you think you are there are going to be accidents that can happen. Equipment can be reenergized without the proper locks and tags to inform personnel that maintenance is being performed on the piece of equipment that you are working on.



**Exit Wound:** Current flows through the body from the entrance point, until finally exiting where the body is closest to the ground. This foot suffered massive internal injuries, which weren't readily visible, and had to be amputated a few days later.

# USACE-AEN CERTIFIED MATERIALS TESTING LABS

BY: Keith Rudie, Quality Assurance Branch

You may have recently noticed emails announcing several lab certification suspensions. This action was motivated by poor workmanship both in the field and in submitted “reports.” The initial AEN certification process appears to have had a strong capacity development component. As the number of certified labs surpassed 50, several began to shake out as poorly trained, ill equipped to handle larger projects, or just plain incompetent. This was bound to happen as the better labs outperformed their colleagues. The problem remained, though, that poorly performing certified labs were still working on Corps projects. The recent suspensions were necessary to “freeze” the actions of the biggest offenders, as identified by the geotechnical team in Kabul, until a more thorough inspection/investigation can be conducted.



The previous SOP for lab inspections has been revised to filter out less qualified labs. Some changes include: More formal education in geotechnical engineering or geology for those seeking soils and aggregate testing certification; submission of actual past reports from both the lab and USACE field offices (when possible); and, performance of corps specified mix designs and testing for concrete and asphalt. As a side note, the first two labs to apply for certification under the new guidelines failed the concrete design mix, and are currently redesigning the mix to re-test. Another change is that USACE-AEN no longer issues remote certifications to labs that cannot be visited in person. Almost all labs based in Kabul will travel anywhere in AEN to sample and test materials. Additionally, these same labs will set up field laboratories for larger, long-term projects.

The goal of these changes is to get better, more precise information from the field, which will allow project engineers to make better decisions based upon accurate site condition assessments. In much the same way, QAB will update the “certified labs” list monthly on the Afghanistan Engineer District website (<https://aedintranet.tac.usace.army.mil>). We realize that some of you in remote locations often find it difficult to connect to the internet, so we will also email the list to all construction and engineering personnel. If you have any certification questions, please feel free to shoot me an email ([keith.a.rudie@usace.army.mil](mailto:keith.a.rudie@usace.army.mil)).

## ADVANTAGES OF USING CHECKLISTS

BY: Tim Inouye, Re-deployed from Bagram Resident Office



Tim Inouye has done two tours here since I've been here and has amazed me with his ability to create wonderful checklists. When Tim came through Qalaa House for his re-deployment, I asked him to write a short paragraph on his inspiration of these checklists. Here's what Tim writes:

I've been a practitioner of “aikido” (a Japanese martial art) for about 23 years overall, and an instructor for the past 12 years. Most martial arts have literally hundreds of movements, attacks, throws, exercises, takedown holds, etc., and to try to memorize even the names (in Japanese) of even fifty-or so arts can be quite challenging-even for someone who speaks Japanese (and I don't speak it none-to-well anymore). The majority of our students are pre-teens, teenagers and young adults,

and to help them (and keep our instruction consistent), I worked with our senior instructors and created several “checklists” about 10 years ago. Guess they're doing the trick since the aikido club is still using them to assist in the aikido instruction and exam preparation. I've continued using this “concept” when I deployed with the HED PRT (Power) team during the Hurricane Katrina recovery mission and made a couple of checklists for the Power QA's, and of course during my time at the Bagram Area Office this past year, since these checklists can be a great tool in double-checking my work (or whatever else I'm inspecting).

Tim's checklists include: QA Smoothness Worksheet, Compressive Strength Worksheet, Flexural Worksheet, QA Pavement Placement Worksheet, and a Specifications Worksheet. You can access these checklists on our Sharepoint site under construction/checklist. If you don't have access to the site, please contact Sandy Higgins at [sandy.m.higgins@usace.army.mil](mailto:sandy.m.higgins@usace.army.mil) or Keith Rudie at [keith.a.rudie@usace.army.mil](mailto:keith.a.rudie@usace.army.mil) and we will send them to you.